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Surface tension of neutron star matter

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The phase transition from hadronic to quark matter may take place already during the early post-bounce stage of core collapse supernovae and in neutron star mergers. If the phase transition is of first order, the formation of the quark matter phase occurs via the nucleation of droplets. The timescales relevant for the phase conversion dynamics, as well as the possibility of mixed phases, are very sensitive to the value of the surface tension in this dense environment. We discuss the computation of the surface tension from the initial purely chiral models to a nucleon-meson model that describes nuclear matter in the low-density sector, with fully broken chiral symmetry, and the approximately chirally restored phase at high density within a unified effective potential. Finally, we incorporate parity doubling, which allows for stable static configurations of stars with a metastable matter core, enabling stars with masses higher than the expected minimum mass of a neutron star formed via core collapse supernova and around the value of the less massive observed neutron star which makes metastability related phenomena particularly relevant. In all cases, we find values of the surface tension that favor the nucleation of quark matter.

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